Load carriage: Impacts and conditioning

Orr, Rob Marc


TSAC
AUSTRALIA
Evidence Based | Tactically Tested | Operationally Proven
TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE


TSAC
AUSTRALIA
Evidence Based | Tactically Tested | Operationally Proven
Load Carriage: Impacts and Conditioning
A/Prof Rob Orr (Bond University)

TACTICAL STRENGTH & CONDITIONING AUSTRALIA

RAPID FIRE MINI CONFERENCE

BLUF:

- A well-structured and periodised load carriage conditioning program can reduce the negative impacts of carrying load and optimise operational performance

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA

RAPID FIRE MINI CONFERENCE

Introduction:

•Tactical operators are required to carry load as part of their occupation

•Carrying these loads can place the operators at risk through reducing occupational task performance and causing injury

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

Risks Associated with Load Carriage

'When you get shot at, you move as fast as you can…but it wasn't very fast. You are just tired. So tired.

Justin Kalentis, US Army, wounded in Afghanistan,
discussing the loads they were carrying
quoted in *The Seattle Times* (14 Feb 11)

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

Risks Associated with Load Carriage

- Injuries: Associated with a variety of injuries (from skin blistering to muscle, ligament, tendon, bone and nervous system injuries)

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

RISKS ASSOCIATED WITH LOAD CARRIAGE

- Decrements in performance:
  - ↓ Mobility

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

RISKS ASSOCIATED WITH LOAD CARRIAGE

- Decrements in performance:
  - ↓ Lethality (Marksmanship / Grenade throw ability)

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

Risks Associated with Load Carriage

- Decrements in performance:
  - ↓ Mobility + ↓ Lethality


EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

Risks Associated with Load Carriage

- Decrements in performance:
  - ↓ Attention to task


EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

Load Carriage Conditioning

- Concept is not new and can be traced back to the Roman Legionnaires

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

Load Carriage Conditioning

Database	Search terms
MEDLINE (Ovid)	load AND carr*; load AND march*; pack AND march*; endurance AND march*
PUBMED	load AND carriage; load AND carry; load AND marching; load AND march; pack AND march; pack AND marching; endurance AND march; endurance AND marching.
PROQUEST	load AND carriage; load AND carry; load AND marching; load AND march; pack AND march; pack AND marching; endurance AND march; endurance AND marching.
CINAHL	load AND carriage OR carry; endurance AND march OR marching; pack AND march OR marching; load AND march OR marching.
DEFWEB	load AND carriage; load AND carry; load AND marching; load AND march; pack AND march; pack AND marching; endurance AND march; endurance AND marching.

Exclusion Criteria	Example:
Participant ages outside typical military service age range of 16 to 65 years	Adolescents
Study included a form of mobility aid	Walking poles
Study included medical supplementation	Ergogenic aids
Study included medically unfit subjects	Idiopathic scoliosis
Study included components in an altered environment	Microgravity, high altitude
Study not published in English	
Study did not include a load carriage variable (dependent or independent); was not specifically related to a load carriage activity; or involved no physical loads being carried	General military conditioning programs
Study had a commercial interest	Commercial backpacks
Defence documents which were rated above "unclassified".	

Orr, R. M., Pope, R., Johnston, V. & Coyle, J. (2010). Load carriage: Minimising soldier injuries through physical conditioning - A narrative review. Journal of Military and Veterans' Health, 18(3), 31-38.

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

Load Carriage Conditioning

- **Initial literature search identified 8,053 papers.**
- **Further 36 papers gathered from colleagues.**
- **8089 papers reduced to 214 papers following implementation of exclusion criteria**
- **Secondary literature search reduced papers to seven original research papers, one conference paper and four secondary source papers (military reports, journal articles).**

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

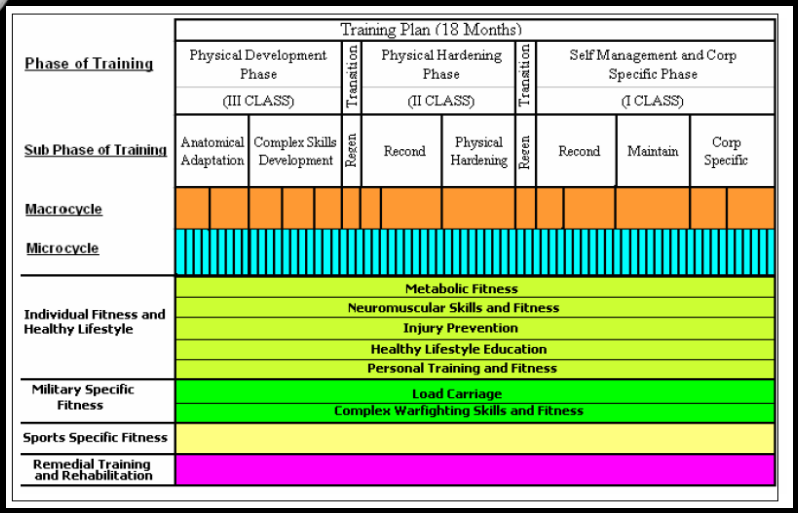
F.I.T.T Formula (Frequency, Intensity, Time & Type)

- **F. 10-14 days per load carriage session**
- **I. To loads required (Last decade 40-50kg) at the speeds and over the terrains required**
- **T. Duration of load carriage operations**
- **T. Load carriage preferable, but combined resistance and cardio may be of some benefit**

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA

RAPID FIRE MINI CONFERENCE

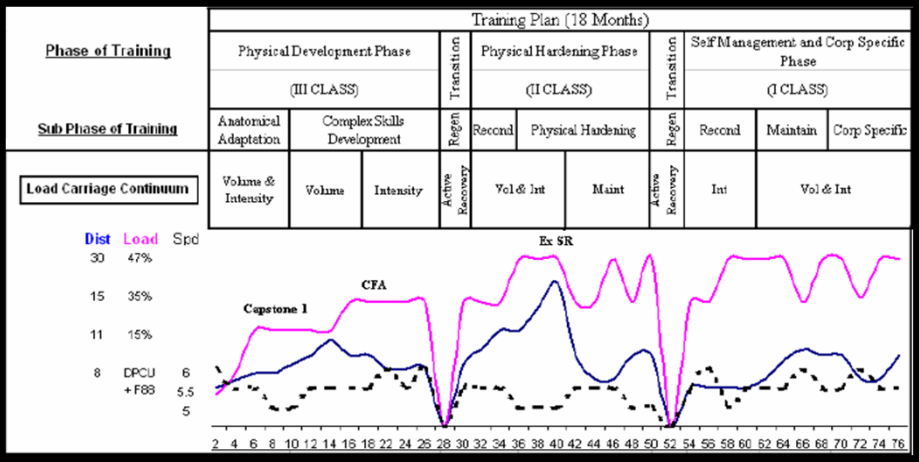


Orr, R. (2010). The Royal Military College - Duntroon. Physical conditioning continuum model. Depa
of Defence, Australia.

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA

RAPID FIRE MINI CONFERENCE



Orr, R. (2010). The Royal Military College - Duntroon. Physical conditioning continuum model.
Department of Defence, Australia.

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

Load Carriage Conditioning

Knapik et al., (2012)

- Method: Review of several literature databases
- Results: 11 Publications from 10 original studies
- Discussion:
  - Substantial trg effect with Progressive RT combined with Aerobic trg (3x4/52)
  - Effects greater when LC added specifically
  - Field based training (inc LC) also very effective
  - RT or Aerobic trg alone had varying effects

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

Take Home:

To improve load carriage performance and reduce the risks associated with load carriage (including injury and reduced tactical performance) a well designed and progressive LC program is needed.

This program would include specific LC events, preferably ever 7-14 days

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

References:

- Drain, J., Orr, R., Attwells, R. & Billing, D. (2012). Load Carriage Capacity of the Dismounted Combatant – A Commander's Guide, *Defence Science and Technology Organisation: Department of Defence*
- Drain, J., Orr, R., Billing, D., & Rudzki, S. (2010). *Human Dimensions of Heavy Load Carriage*. Paper presented at the Land Warfare Conference 2010 in Brisbane, Australia 15 – 19 November 2010.
- Knapik, J. J., Johnson, R. F., Ang, P., Meiselman, H., Bensel, C. K., Johnson, W., et al. (1993). Road March Performance of Special Operations Soldiers Carrying Various Loads and Load Distributions. T14-93. Military Performance Division. US Army Research Institute of Environmental Medicine, Natick, 136.

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN

TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE

References:

- Knapik, J. J., Harman, E., Steelman, R.A. & Graham, B.S. (2012). A Systematic Review of the Effects of Physical Training on Load Carriage Performance, 26(2), 585-597.
- Knapik, J. J., Reynolds, K. L., & Harman, E. (2004). Soldier load carriage: historical, physiological, biomechanical, and medical aspects. Mil Med, 169(1), 45-56.
- Knapik, J. J., Reynolds, K. L., Staab, J., Vogel, J. A., & Jones, B. (1992). Injuries associated with strenuous road marching. Mil Med, 157(2), 64-67.
- Orr, R. (2010). The history of the soldier's load, Australian Army Journal, vii(2), 67-88
- Orr, R., Pope, R., Johnston, V., & Coyle, J. (2011). Load carriage and its force impact, Australian Defence Journal, 185, 52-63

EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN


TACTICAL STRENGTH & CONDITIONING AUSTRALIA
RAPID FIRE MINI CONFERENCE
References:
• Orr, R., Pope, R., Johnston, V., & Coyle, J. (2010). Load carriage: Minimising soldier injuries through physical conditioning – a narrative review, Journal of Military and Veterans' Health, 18(3), 31-38
• Orr, R. (2012-Submited), Soldier Load Carriage: A Risk Management Approach. PhD Thesis, University of Queensland
• Park, K., Hur, P., Rosengren, K. S., Horn, G. P., & Hsiao-Wecksler, E. T. (2010). Effect of load carriage on gait due to firefighting air bottle configuration. Ergonomics, 53(7), 882-891.
• Park, K., Hur, P., Rosengren, K. S., Horn, G. P., & Hsiao-Wecksler., E. T. (2008). Changes In Kinetic And Kinematic Gait Parameters Due To Firefighting Air Bottle Configuration. Paper presented at the NACOB, Ann Arbor, Michigan, U.S.A
EVIDENCE BASED . TACTICALLY TESTED . OPERATIONALLY PROVEN